

Workshop on NDT and SHM requirements for wind turbines

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About FORCE Technology

We:

- are one of the leading technological service companies on the international market
- are independent and self-governing
- have a strong Scandinavian base

Our:

- work is based on the most recent technological knowledge
- development budget is more than 26 mill. EUR

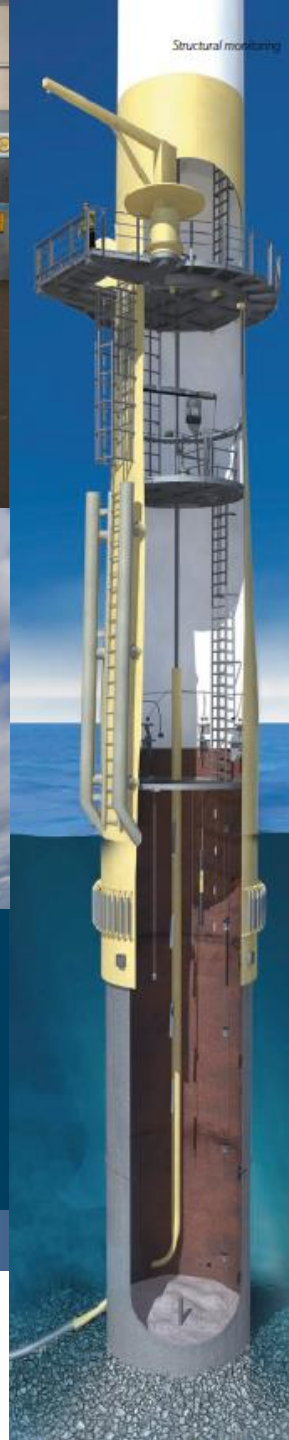
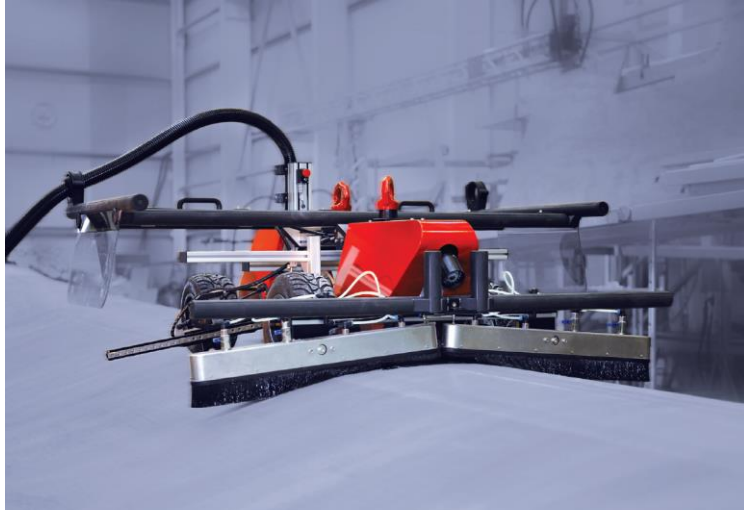
We transform highly specialised engineering knowledge into practical and productive solutions for a number of industries.

A GTS COMPANY

As a GTS company, we are dedicated to develop and use technologies and new knowledge for the benefit of Danish companies and the Danish society as a whole.



ADVANCED
TECHNOLOGY GROUP



Blades, Towers and Foundations production and on-site

FORCE Technology

FORCE and Wind Turbines

- Testing prototype blades for the pioneering Danish wind turbine industry



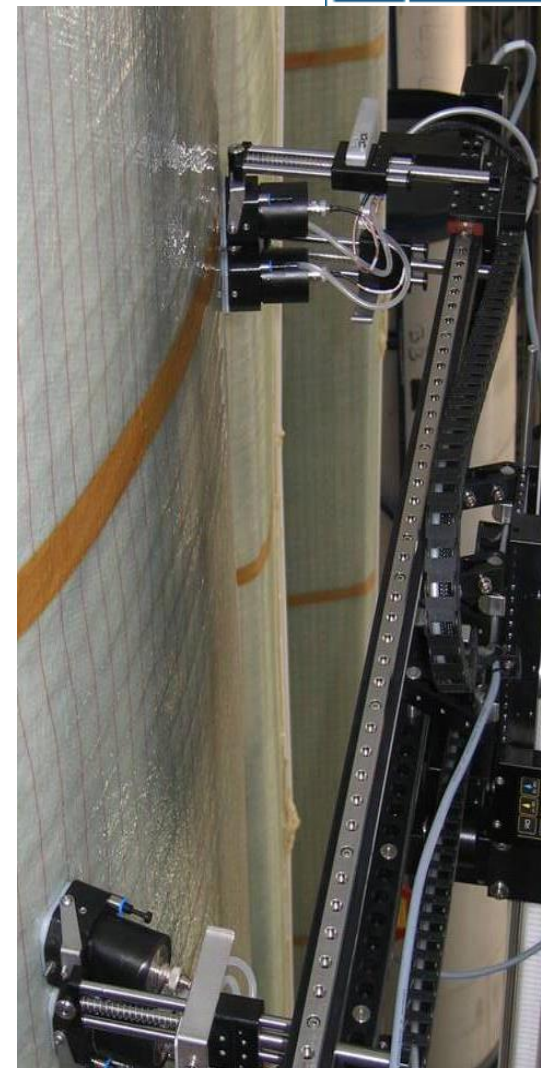
Ultrasonic Testing of production blades



The P-scan Stack System
Developed for operators by operators

Objective

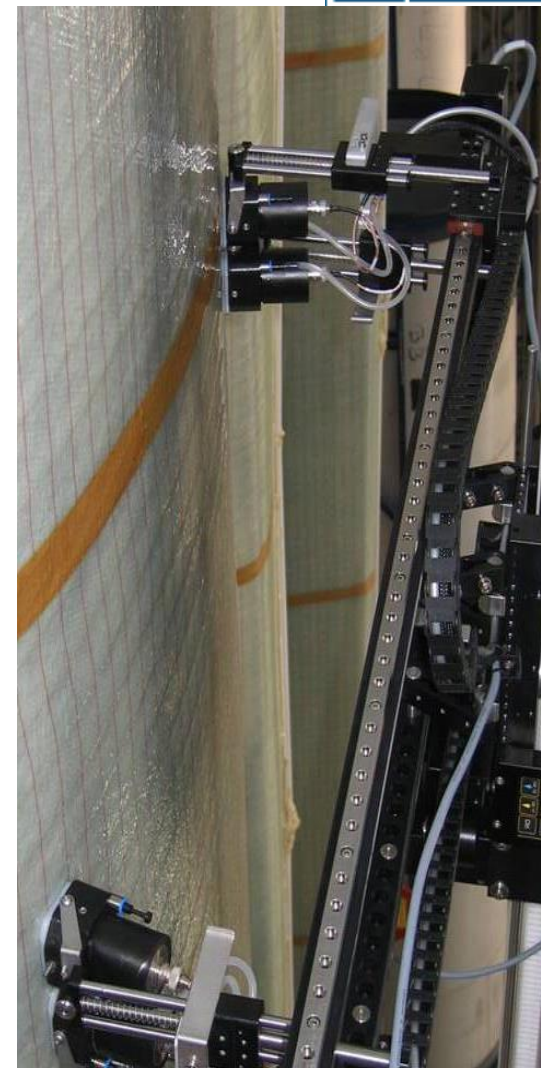
- Very fast inspection of large blades, typically 2-5 hours
- One man operation, level 1 UT for data collection
- Full digital documentation, data analysis review, comparison to in-service inspection data



Challenge – NDT prioritizing

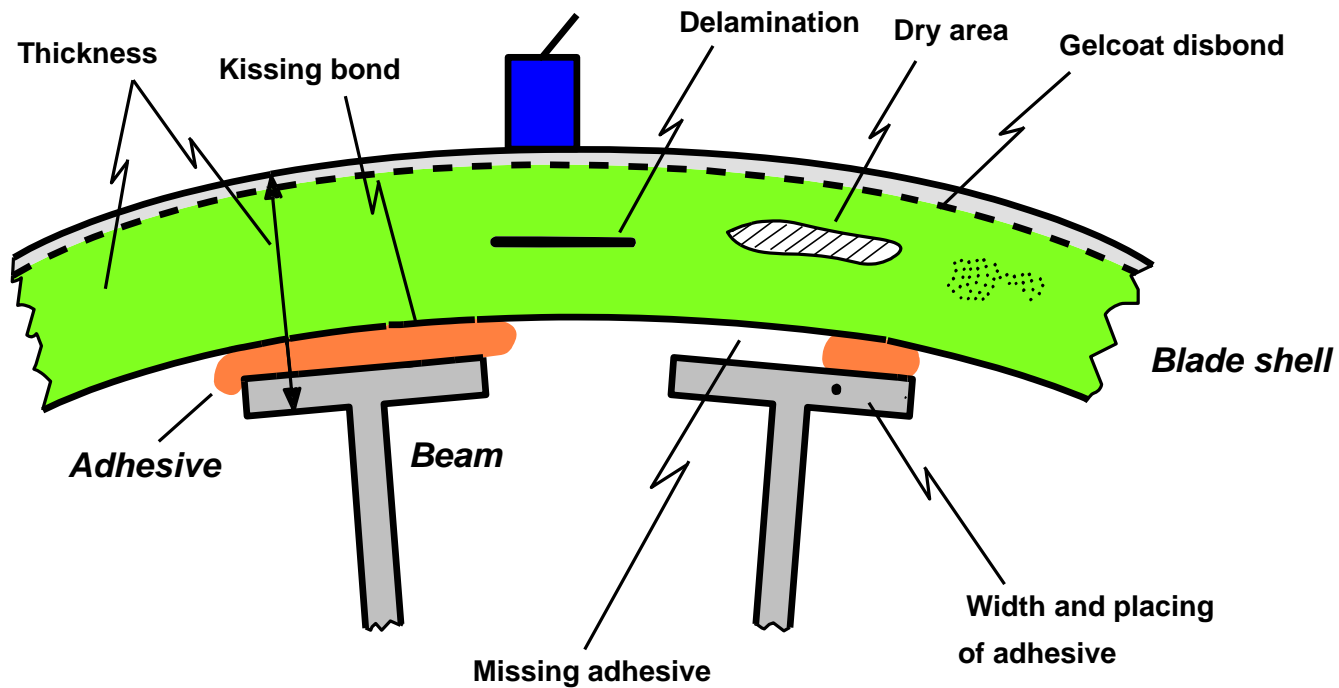
- Blade design
 - Critical defects
 - Size and measuring tolerances

- Blade production
 - Critical defects
 - Inspection time

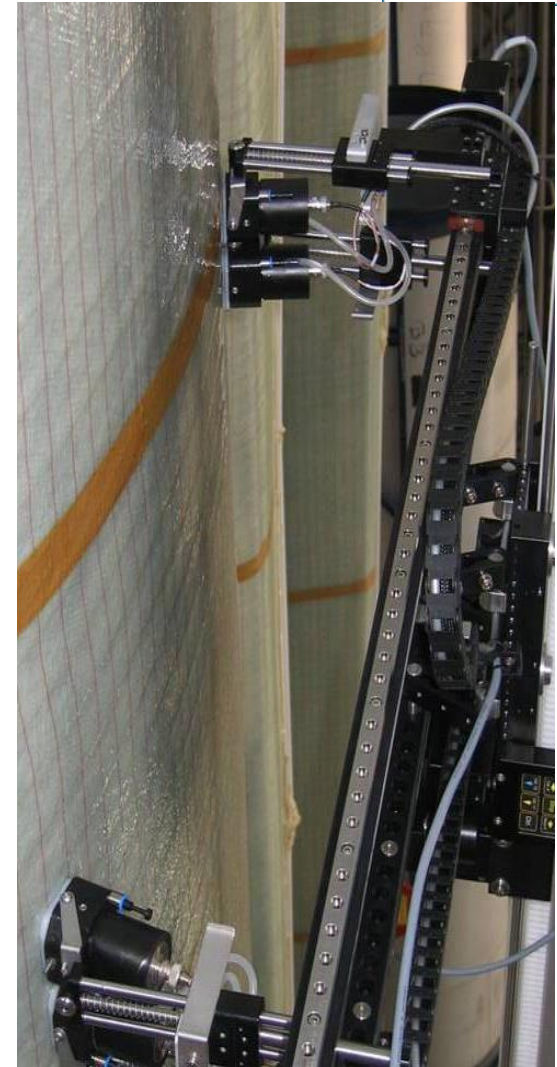
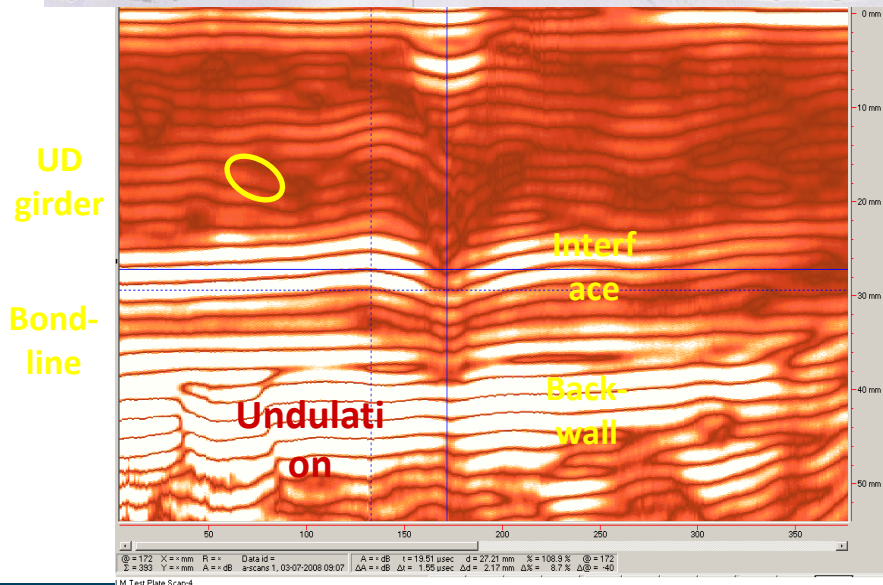
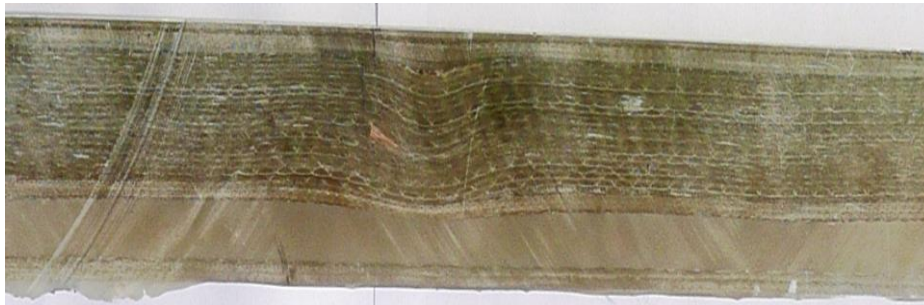


Defect types

Failures and Defects detectable by Automated Ultrasonic Inspection



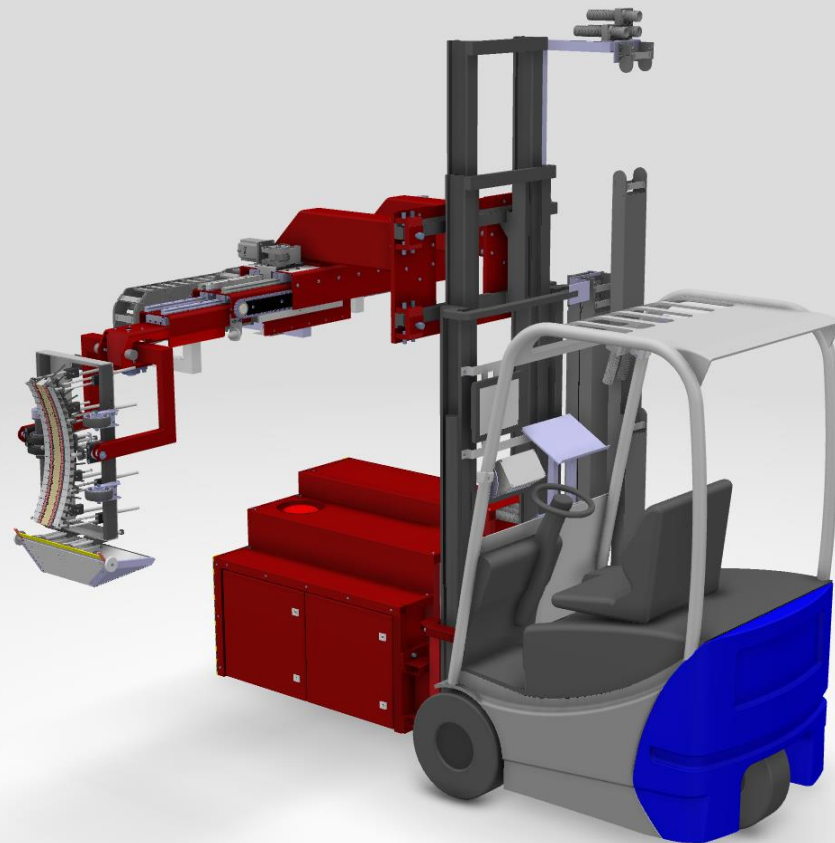
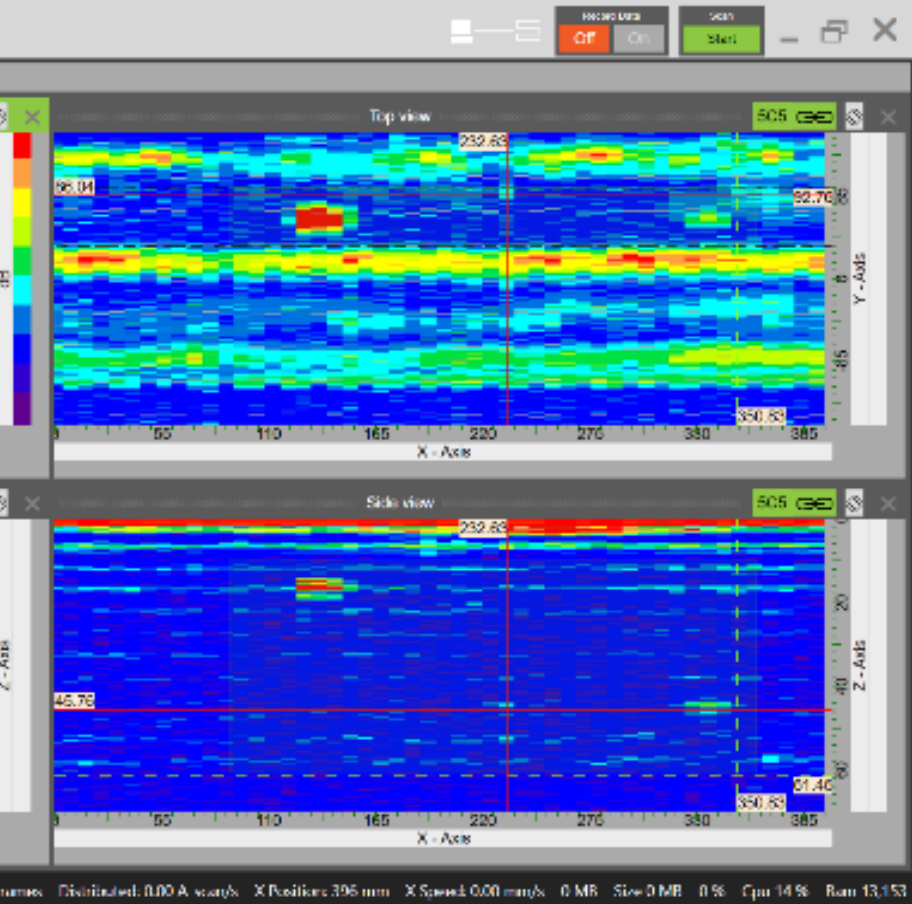
Defect type: Wrinkles



Automated Scanner Systems – AMS-71



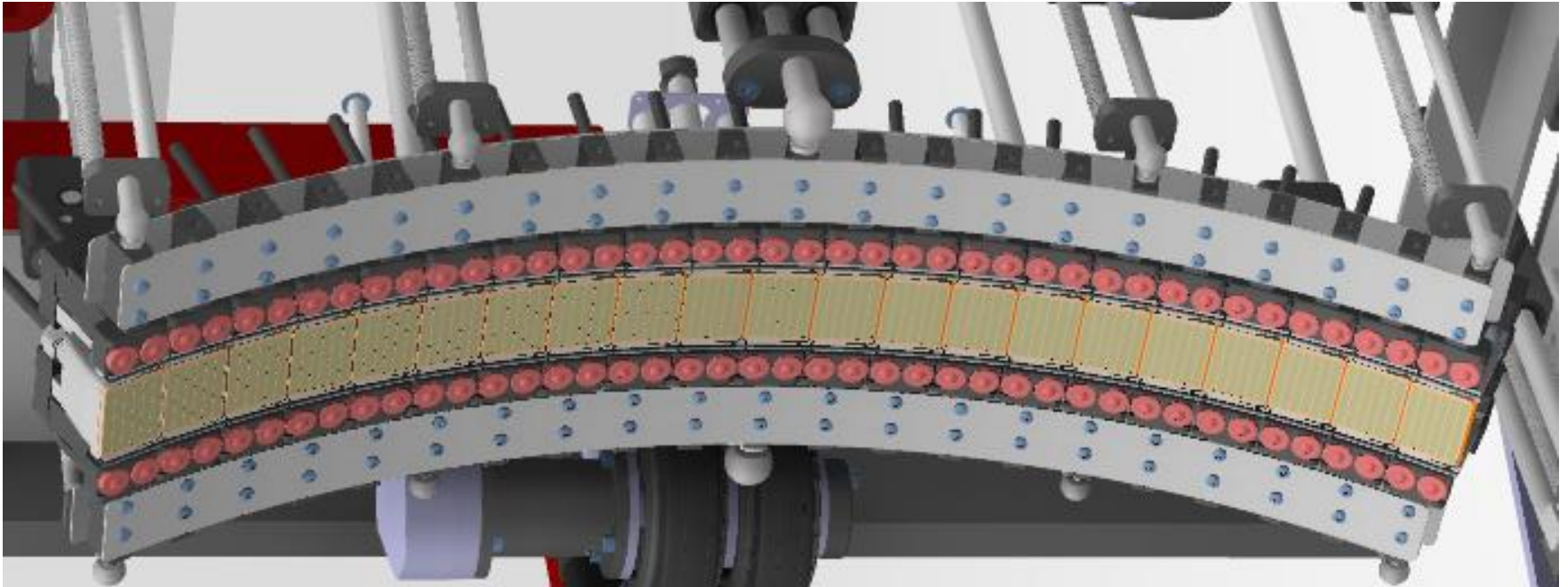
The P-scan Stack System
Developed for operators by operators



New blade scanner system AMS-71 PA²

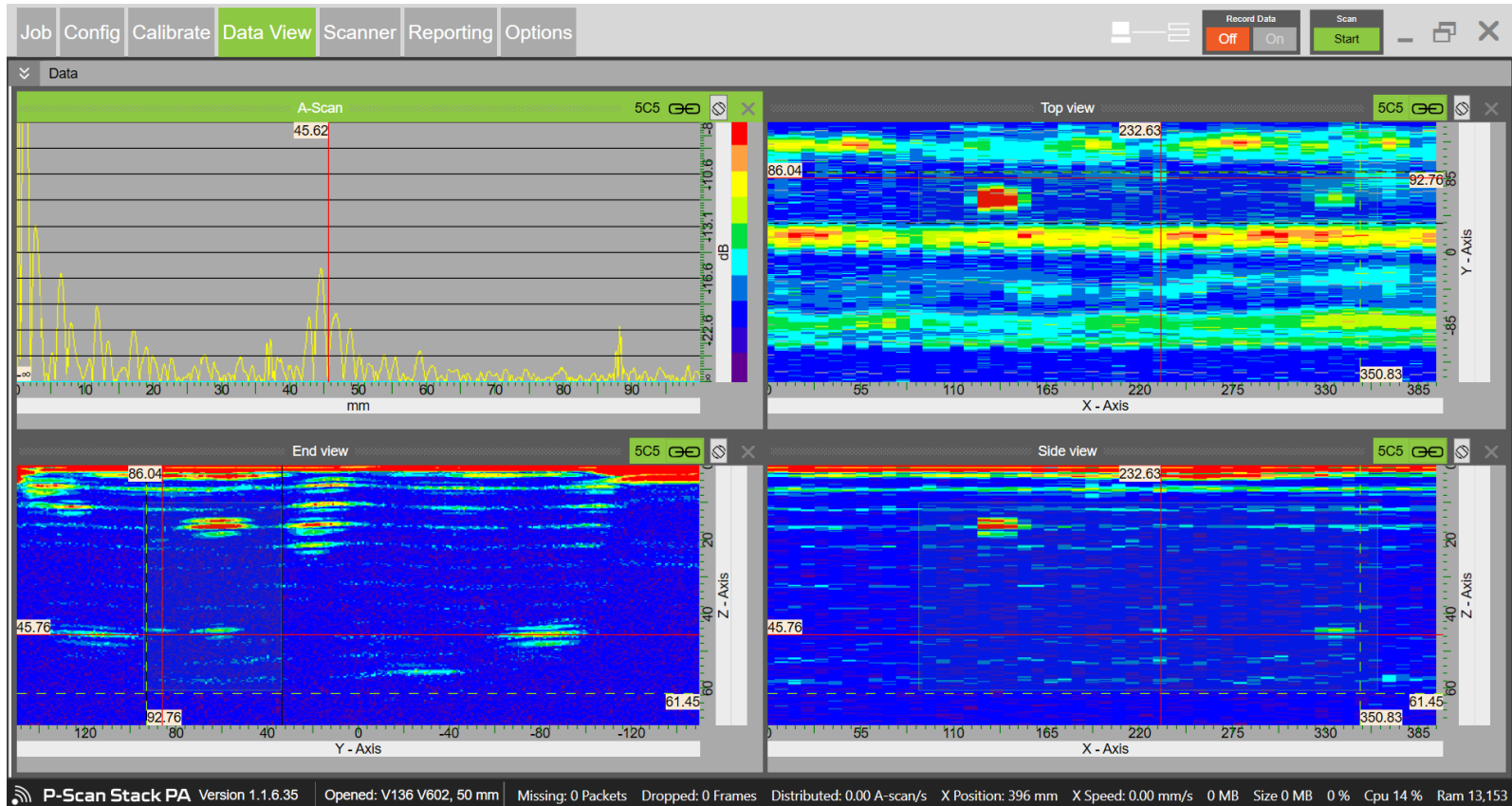
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P-Scan PA² evolution



P-Scan PA² probes and probe holder

Data presentation



Vacuum crawler for on-site blade inspection



- Patented crawler with one or more vacuum-distribution chambers
- Remote controlled movement on any blade orientation
- Self propelled device for transporting sensors
 - Ultrasonic, Visual, Thermal, SAR-Radar, Sherography ...
- Flexible belts with absorbency on vertical, rough and uneven surfaces
- Dimensions: 580 x 710 x 195 mm
- Weight: 20 kg
- Lift capacity: up to 40 kg
- Speed: 50 mm/s (3 m/min)

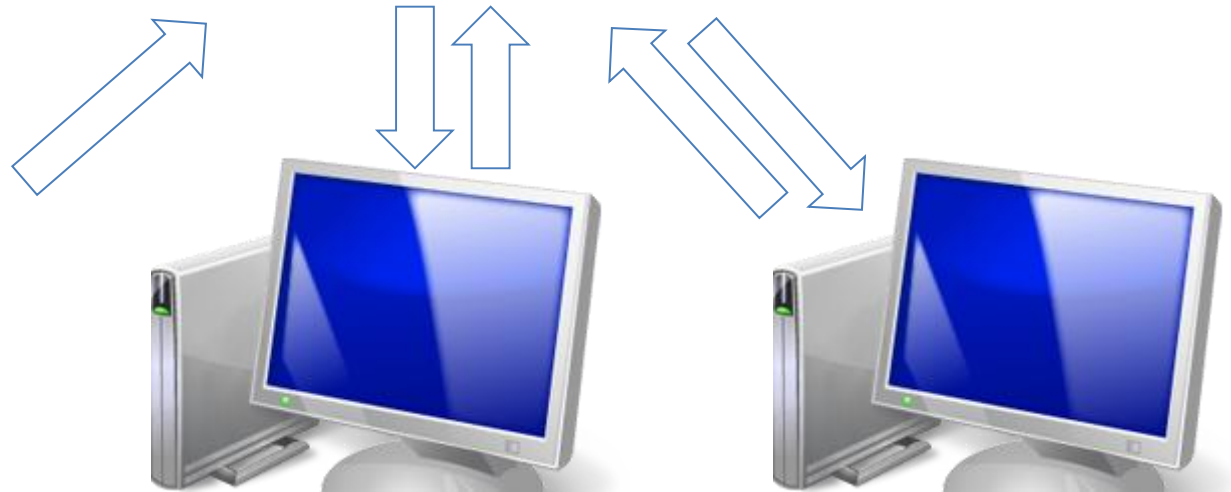
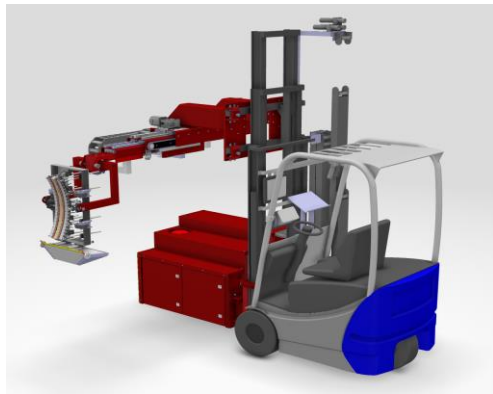


Technical specifications

- Channels 32/64 to 256/512 PA, 8 to 32 PE
- Large frequency range, 0,05 to 30 MHz
- High transmitter amplitude, 80 to 200 V, rectangular, bipolar
- **High dynamic range for amplifier, >100 dB @ 5 MHz**
- Input noise, (high signal to noise ratio) <2 nV/√Hz
- Integrated scanner controller for up to 15 axis



Cloud solution for inspection data



Data upload from scanner

Manual analysis

Automated analysis

Research Projects

Made Spir

- Siemens and FORCE: Automated system for Automated Measurement of actual blade geometry.

Made Digital

Vestas-DTU-FORCE: Automated Evaluation using Machine Learning Applied on UT blade inspection data.

RELIABLADE

- DTU-Vestas-FORCE-IBM-Dantec Dynamic and others: Improving Blade Reliability through Application of Digital Twins over Entire Life Cycle

RELIABLEBLADE

